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From the International Desk

Undergraduate Research and Inquiry in the Netherlands

The identity of many, if not all, Dutch research universities traditionally was based on the connection between research and teaching at the individual institutions, as von Humboldt advocated at the beginning of the 19th century (Jenkins and Healey 2010; Schimank and Winnes 2000). Hence, the leading characteristic of the Dutch research universities originally was the joint search for knowledge by the faculty and students. However, due to the “massification” of higher education since the 1960s, research and teaching increasingly have been separated within European higher education institutions (Leisyte et al. 2009; Schimank and Winnes 2000). High expectations of faculty for scientific publications increased at the same time that attention to teaching and learning also increased. The rise of mandatory teaching qualifications for faculty followed: all research universities in the Netherlands are currently working toward mandatory pedagogical training for new faculty members, which involves pedagogical training modules, as well as explicit reflection on teaching practice. Furthermore, growing expectations for Dutch higher education institutions, (universities as well as institutes for higher professional education), including the recognition of their importance for the “knowledge” society, caused a rethinking of their internal organization and their role in society (Leisyte et al. 2009). In this context, the connection between teaching and research has gained renewed attention in recent decades, as it offers universities a way to distinguish themselves from other institutions (Elsen et al. 2009).

More and more institutions incorporate some kind of connection between research and teaching in their mission statements. However, when we examine the bachelor's degree programs at these universities, usually students are only actively engaged in disciplinary research in their final year, as part of their mandatory theses—comparable to the situation in Canada, for example (Vajoczki 2010). At research universities the theses are normally based on an independent research project of three months, supervised by one of their teachers. Bachelor's theses at institutes for higher professional (applied) education, which only provide bachelor's level education, cover a wider range of final projects.

It is rather uncommon for bachelor's level students to be engaged in undergraduate research projects from the start of their degree programs, and even more uncommon for these students to participate in the research activities of their faculty members. However, some promising developments can be seen across the country. An inspiring experience was the first Student Research Conference in the Netherlands, organized at Leiden University in 2010 (see <http://www.vsnul.nl/Subsites-1/SRC.htm>). Dutch universities joined forces to show the scientific and creative potential of undergraduate research. The association of universities in the Netherlands (VSNU) would like this intellectually stimulating event to become an annual national platform for showcasing outstanding undergraduate research in the Netherlands. The second event was held in autumn 2011 at Eindhoven University of Technology (see <http://www.vsnul.nl/Subsites/SRC.htm>).

The renewed attention to the relationship between research and teaching in the Netherlands has led to several initiatives within higher education institutions. These include the introduction of undergraduate research projects from the first year onward, restructuring of research methodology courses and other curricular innovations, and research-based learning. In this article we concentrate on the attempts of research universities in the Netherlands to integrate undergraduate research activities into their curricula, while recognizing the changes that also are taking place in the institutes for higher professional education. We describe two examples from two Dutch research universities that are in different stages of development and that involve differing numbers of students. The first case portrays a program in which students are engaged in research at the institution from the first year onward, and the second case describes a curriculum change leading toward a research-based curriculum.

The Netherlands' National Context

Nearly all universities in the Netherlands are funded by the government, although students also pay a moderate tuition fee. The institutions are accredited by an independent organization that sets criteria for the quality of research, the

quality of teaching, and the quality of the internal quality assurance system.

A central characteristic of Dutch higher education is its binary structure, which divides research universities from institutions for higher professional education. The two types of institutions have developed separately, with different rationales and purposes (De Weert 2006). Institutions for higher professional education mainly provide four-year bachelor's programs, while research university students are expected to obtain both a bachelor's degree (after three years of study) and a master's degree (during a fourth year and/or fifth year). The doctorate can be obtained only at research universities, where PhD candidates are perceived as junior researchers, not students. Currently, there are 14 research universities and 41 institutions for higher professional education in the Netherlands. Outside of the country, the institutions for professional education explain themselves as "universities of applied sciences."

At present, the emphasis of Dutch research universities is on excellence in research, while the institutes for higher professional education emphasize teaching and learning. This affects the promotion and reward structures for staff members at the institutions. While staff at research universities are mainly rewarded and promoted based on the quality of their research, staff members at the institutes for professional education are promoted based primarily on the quality of the education they provide their bachelor's students. Although some faculty members at the professional education institutes do engage in research, this is not a requirement for all faculty members. The research programs at the professional education institutes are centered around "lecturers" who lead research teams on topics related to the programs offered. Undergraduates at these institutions increasingly are provided with opportunities to conduct small-scale research projects, and their faculty members are more and more encouraged to carry out research themselves, although many faculty members feel unprepared for this task (Griffioen and De Jong 2010). The bottom line is that undergraduates at these institutions have more and more opportunities to participate in faculty research projects. Thus, undergraduate research is no longer just reserved for undergraduates at research universities.

The research emphasis in the institutions for higher professional education is on applied research in order to improve

professional practice. In general, the purpose of student research in these institutions is to train "scholarly professionals"—practitioners in various occupations who are informed by research results. This contrasts with the main purpose at research universities, which is to train "professional scholars." Thus although undergraduates at both kinds of institutions have opportunities to conduct research, the types of projects undertaken differ. Undergraduate projects at research universities often relate to the fundamental research being pursued by their faculty members, while undergraduate projects at institutions of higher professional education mainly relate to applied research and the improvement of professional practice in various fields. These different goals typically influence the character and methodologies of the projects.

The European Context

Many authors have stressed the importance of the shift in higher education in recent decades from small elite institutions to large open institutions (Brew 2006; Elen et al. 2007; Leisyte et al. 2009). In the 1950s, only about 5 percent of each cohort of students went on to higher education in Europe; by the 1990s, this number increased to about 20 to 30 percent of each cohort (Schimank and Winnes 2000). In the Bologna declaration, European countries agreed to aim for 50 percent of each cohort entering higher education by 2010 (European Ministers of Education 1999). Since the Bologna declaration, emphasis also has been put on the "internationalization" of higher-education systems of the European Union's member states (Elen and Verburgh 2008). Following the Bologna declaration, universities in the Netherlands underwent several changes, including the introduction of a system composed of three education levels: bachelor's degree, master's degree, and doctorate. Until 2002 the universities provided an integrated master's degree of four years, followed by the doctorate, while the institutes for higher professional education offered a four year "diploma" program. These changes have led to a more accessible system for potential students and staff members from outside of the Netherlands and more international opportunities for Dutch students. Because of the Bologna declaration, it is likely that the European higher education system will evolve to become more like the U.S. system, which is also based on a "common terminology and generic

frameworks, but heterogeneous in the way the institutions operate" (De Wit 2006).

Case Study #1: Immerse Students in Research

As noted above, many undergraduate research projects in the Netherlands are scheduled in the final year of students' bachelor's degree programs; often the undergraduate research is part of students' thesis projects. In the following we describe how undergraduate research can be an integral part of a bachelor's degree program in the Netherlands. Up to 110 students are admitted annually to the Molecular Science & Technology (MST) program, which is a joint program of two research universities, Leiden University and Delft University of Technology. All students are immersed in disciplinary research from the first day of their studies; they are actively engaged in faculty members' research, conducted within the research groups at the institutions.

In the joint program, the nexus between teaching and research is explicitly stressed, not only because high-quality teaching and research increase the appeal for talented students, but also because of the improved student learning that a focus on this nexus can provide. Students are brought as quickly as possible into contact with disciplinary research. Further, to the degree possible, theory, knowledge, and skills are related to existing scientific research. From the beginning of the program, students work on open problems, which do not have a pre-defined answer. Students must collect information, look up research methods, study these methods, and adapt them to their projects. This bachelor's program intends to acquaint students at an early stage with scientific research and the development of disciplinary knowledge.

Several areas of student competence are outlined as goals for the program. Some of these competence areas very explicitly concern the graduate as a "professional scholar," while in others, research is more implicit. One of the competence goals, for example, is that the "graduated bachelor is knowledgeable in the scientific discipline, is familiar with existing scientific knowledge and has the competence to develop his knowledge through research."

The structure of the program emphasizes disciplinary research by using a curriculum that constructively develops students' research skills. Beginning in their first year

of study, students take part in at least three undergraduate research projects within different research groups. Before the students start their work in the research groups, they enroll in a basic laboratory skills practicum in order to gain essential research skills. Then under the supervision of staff members, students take part in current research two days a week for ten weeks. At the end of this period, they present a poster about the research project to their peers and to staff members.

In focus group interviews about the program, students said they perceived designing and performing actual research as a difficult and challenging task. The students indicated that they learned a lot from applying different research methods, reading research literature, interpreting results, working independently, and dealing with setbacks. The results from student evaluation questionnaires showed that students who participated in the MST program were more enthusiastic about doing research than those who reproduced existing research results in a more traditional skills practicum.

Regarding supervision, students said that they desired a good deal of guidance at the beginning of their projects and then were comfortable later on with more and more autonomy. Some students initially were frustrated by the lack of support they received, but in the end saw the benefits of their struggles in that they were forced to learn to think for themselves. Student evaluations showed that the type of supervision varied among the different research groups. Some students were supervised by graduate assistants, others by tenured faculty members. As a result, additional training sessions were held for graduate assistants on how to supervise student research projects.

Many students remarked that the program engaged them more strongly and made them invest more time in their studies in comparison with students in the more traditional skills practicum. This increase in time invested by students doing an undergraduate research project is a recurring result in international research on how students experience the research-teaching nexus (Healey et al. 2010).

Case Study #2: Serving Large Numbers of Students

Some might say that undergraduate research can only be effective in small elite universities, because intensive guidance by faculty members is rather expensive for institutions with large enrollments. Program managers at higher education institutions in the Netherlands struggle with this issue. Maastricht University resolved this problem by using the problem-based learning (PBL) concept to structure research-based learning activities, in which students work in small groups on authentic research problems under the guidance of a tutor (Bastiaens 2010). Currently, staff members at Tilburg University are using a similar approach to design a new research-based curriculum for the bachelor's program in business economics, which admits up to 600 first-year students.

At Tilburg University, much effort has been put into becoming internationally recognized as a top research institution, but faculty members were not being rewarded for the quality of their teaching. The board of the Tilburg School of Economics & Management decided on a business plan to improve university teaching and learning. A new mission statement was developed in order to combine the faculty strengths in both research and teaching. Recent educational literature provided multiple ideas and terminology for developing the new concept of "research-based learning" (Brew 2006; Healey 2005; Healey and Jenkins 2009). The new curriculum of the bachelor's program in business economics was set to begin in September 2011. The three educational principles undergirding the revised curriculum are 1) to provide a strong nexus between research and teaching; 2) to emphasize student engagement; and 3) to use innovative teaching strategies and approaches related to instructional formats, educational tools, and learning environments.

Although the majority of the program's graduates will not enter an academic career, the school's board emphasizes the importance of immersing students in research from students' first year at the university. However, students who enter Tilburg University are not yet equipped to embark on research projects on their own. The new curriculum, therefore, fosters gradual student development toward more autonomy in doing research. Effectively, the new courses foster student engagement in all kinds of research activities (Visser-Wijnveen et al. 2010). The general idea is that stu-

dents within the new research-based curriculum are actively confronted with research skills in all courses. The development of research skills is fostered by a gradual increase in the level of abstraction and autonomy (cf. Elsen et al. 2009). In order to stimulate student engagement in all courses, a variety of different instructional formats and ways to integrate research and teaching will be incorporated into the new curriculum. For example, in the freshman macro-economic course the lecturer might present an overview of the state-of-the-art in the field and relate that to recent events in the news. In other freshman courses the emphasis could subsequently be put on data gathering or data analysis. Freshmen could also be challenged to learn how to search literature databases effectively.

The limited time faculty members have available for teaching provided a major challenge for this innovation, especially given the need to provide feedback on the research projects to all students. Since student numbers are rather large, teachers are often faced with great amounts of student work that has to be assessed. Innovative teaching strategies, such as peer feedback and digital tools, might help teaching staff to effectively support all students. Teacher training and other professional development initiatives pay special attention to this challenge.

Conclusion

We have discussed the fact that initiatives to provide undergraduates with opportunities for research are present in Dutch higher education, even though there is little national coordination of such efforts. Initiatives are most often located at a single institution or are part of a single program, although individual faculty initiatives and the national undergraduate research conference have revealed promising new developments. However, it should be noted that the nexus between research and teaching is a formal part of the accreditation of research universities. Additional teacher training, for example on how to supervise undergraduate research and how to include research in various forms of teaching, might help to inspire faculty members (Van der Rijst 2009).

Research universities in the Netherlands are increasingly receptive to the idea that undergraduate research is a potentially beneficial way to strengthen teaching and learning,

while at the universities for applied sciences, undergraduate research can also be a way to strengthen the new research identity of the institutions. However, we need to understand that disciplines, as well as institutions, have their own traditions, resulting in different research approaches, methodologies, and cultures (Becher and Trowler 2001). Undergraduate research projects may thus have different orientations within each institution. For instance, undergraduate research at research universities might emphasize fundamental research, whereas undergraduate research at institutions for applied sciences might stress applications of research outcomes to professional practice.

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